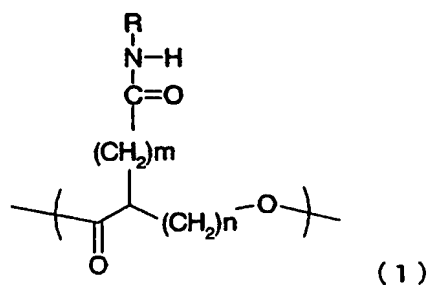


CLAIMS

1. A polyhydroxyalkanoate comprising one or more units represented by the chemical formula (1) in a molecule,

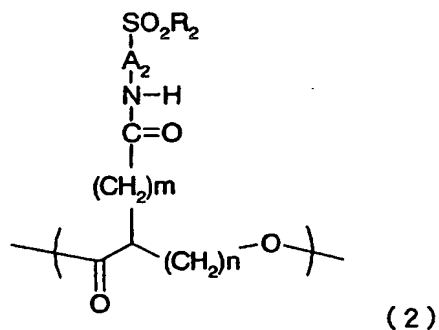


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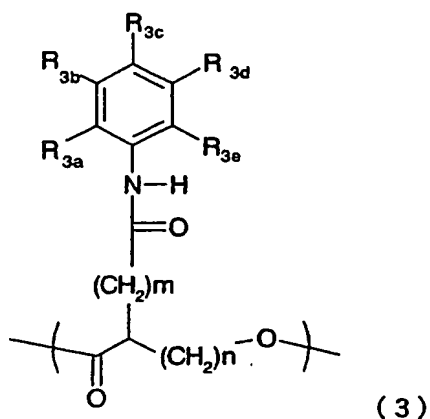
Wherein R represents $-A_1-SO_2R_1$, R_1 represents OH, a halogen atom, ONa, OK, or OR_{1a} , R_{1a} and A_1 each independently represent a substituted or unsubstituted aliphatic hydrocarbon structure, a substituted or unsubstituted aromatic ring structure, or a substituted or unsubstituted heterocyclic structure, n represents an integer selected from 1 to 4, m represents an integer selected from 0 to 8, and when multiple units exist, R, R_1 , R_{1a} , A_1 , m, and n each independently have the above meaning for each unit.

2. A polyhydroxyalkanoate according to claim 1, comprising one or more units each represented by the chemical formula (2), (3), (4A), or (4B) in a molecule as the units of the chemical formula (1),

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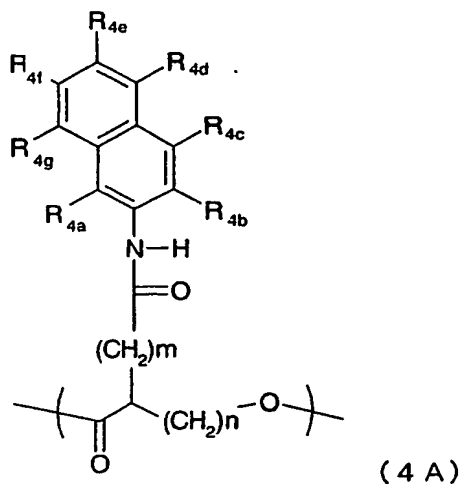


wherein R_2 represents OH, a halogen atom, ONa, OK, or OR_{2a} , R_{2a} represents a linear or branched alkyl group having 1 to 8 carbon atoms, or a substituted or unsubstituted phenyl group, A_2 represents a linear or branched alkylene group having 1 to 8 carbon atoms, n represents an integer selected from 1 to 4, m represents an integer selected from 0 to 8, when multiple units exist, A_2 , R_2 , R_{2a} , m , and n each independently have the above meaning for each unit,



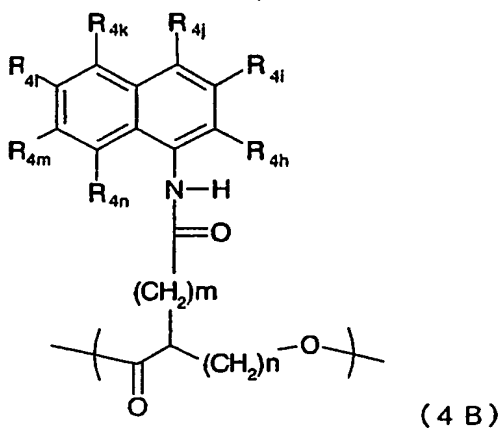
wherein R_{3a} , R_{3b} , R_{3c} , R_{3d} , and R_{3e} each independently represent SO_2R_{3f} (R_{3f} represents OH, a halogen atom,

ONa, OK, or OR_{3f1} (R_{3f1} represents a linear or branched alkyl group having 1 to 8 carbon atoms, or a substituted or unsubstituted phenyl group)), a hydrogen atom, a halogen atom, an alkyl group having 1 to 20 carbon atoms, an alkoxy group having 1 to 20 carbon atoms, an OH group, an NH_2 group, an NO_2 group, $COOR_{3g}$ (R_{3g} represents an H atom, an Na atom, or a K atom), an acetamide group, an OPh group, an NHPh group, a CF_3 group, a C_2F_5 group, or a C_3F_7 group (Ph represents a phenyl group), and at least one of these groups represents SO_2R_{3f} , n represents an integer selected from 1 to 4, m represents an integer selected from 0 to 8, and when multiple units exist, R_{3a} , R_{3b} , R_{3c} , R_{3d} , R_{3e} , R_{3f} , R_{3f1} , R_{3g} , m, and n each independently have the above meaning for each unit,



Wherein R_{4a} , R_{4b} , R_{4c} , R_{4d} , R_{4e} , R_{4f} , and R_{4g} each independently represent SO_2R_{4o} (R_{4o} represents OH, a

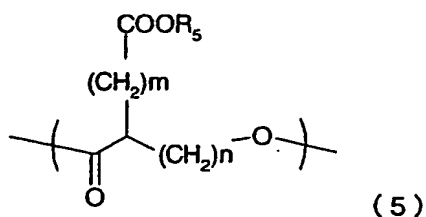
halogen atom, ONa, OK, or OR_{4o1} (R_{4o1} represents a linear or branched alkyl group having 1 to 8 carbon atoms, or a substituted or unsubstituted phenyl group)), a hydrogen atom, a halogen atom, an alkyl group having 1 to 20 carbon atoms, an alkoxy group having 1 to 20 carbon atoms, an OH group, an NH₂ group, an NO₂ group, COOR_{4p} (R_{4p} represents an H atom, an Na atom, or a K atom), an acetamide group, an OPh group, an NHPPh group, a CF₃ group, a C₂F₅ group, or a C₃F₇ group (Ph represents a phenyl group), and at least one of these groups represents SO₂R_{4o}, n represents an integer selected from 1 to 4 and m represents an integer selected from 0 to 8, and wherein multiple units exist, R_{4a}, R_{4b}, R_{4c}, R_{4d}, R_{4e}, R_{4f}, R_{4g}, R_{4o}, R_{4o1}, R_{4p}, m, and n each independently have the above meaning for each unit),



wherein R_{4h}, R_{4i}, R_{4j}, R_{4k}, R_{4l}, R_{4m}, and R_{4n} each

independently represent SO_2R_{4o} (R_{4o} represents OH, a halogen atom, ONa, OK, or OR_{4o1} , (R_{4o1} represents a linear or branched alkyl group having 1 to 8 carbon atoms, or a substituted or unsubstituted phenyl group)), a hydrogen atom, a halogen atom, an alkyl group having 1 to 20 carbon atoms, an alkoxy group having 1 to 20 carbon atoms, an OH group, an NH_2 group, an NO_2 group, COOR_{4p} (R_{4p} represents an H atom, an Na atom, or a K atom), an acetamide group, an OPh group, an NHPH group, a CF_3 group, a C_2F_5 group, or a C_3F_7 group (Ph represents a phenyl group), and at least one of these groups represents SO_2R_{4o} , n represents an integer selected from 1 to 4, m represents an integer selected from 0 to 8, and wherein multiple units exist, R_{4h} , R_{4i} , R_{4j} , R_{4k} , R_{4l} , R_{4m} , R_{4n} , R_{4o} , R_{4o1} , R_{4p} , m, and n each independently have the above meaning for each unit.

3. A polyhydroxyalkanoate comprising one or more units represented by the chemical formula (5),

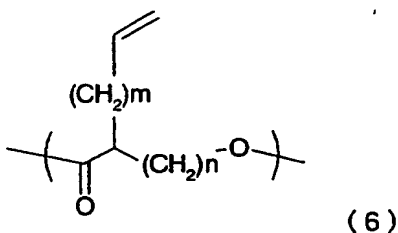


Wherein R_5 represents a hydrogen atom, a group for forming a salt, or R_{5a} , R_{5a} represents a linear or

branched alkyl or aralkyl group having 1 to 12 carbon atoms, or a group having a saccharide, n represents an integer selected from 1 to 4, m represents an integer selected from 0 to 8, when n = 4, R₅

5 represents only a group having a saccharide for m = 0, and when multiple units exist, R₅, R_{5a}, m, and n each independently have the above meaning for each unit.)

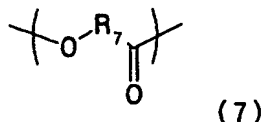
4. A polyhydroxyalkanoate comprising one or more units represented by the chemical formula (6),



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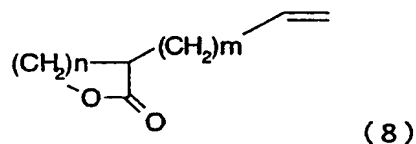
wherein n represents an integer selected from 1 to 4, when n represents an integer selected from 1, 2, and 4, m represents an integer selected from 0 to 8, when n = 3, m represents an integer selected from 0 and 2
15 to 8, and when multiple units exist, m and n each independently have the above meaning for each unit.

5. A polyhydroxyalkanoate according to any one of claims 1 to 4, further comprising a unit represented by the chemical formula (7) in a molecule,

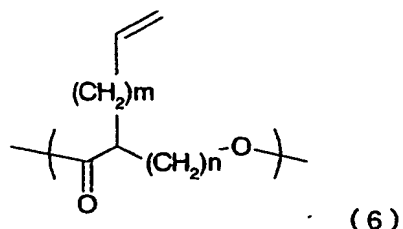


wherein (R₇ represents a linear or branched alkylene group having 1 to 11 carbon atoms, an alkyleneoxyalkylene group each alkylene of which has 1 or 2 carbon atoms (alkylene groups each independently have 1 or 2 carbon atoms), or an alkylidene group having 1 to 5 carbon atoms which may be substituted by aryl, and when multiple units exist, R₇'s each independently have the above meaning for each unit.

6. A method of producing a polyhydroxyalkanoate represented by the chemical formula (6), comprising the step of polymerizing a compound represented by the chemical formula (8) in the presence of a catalyst,

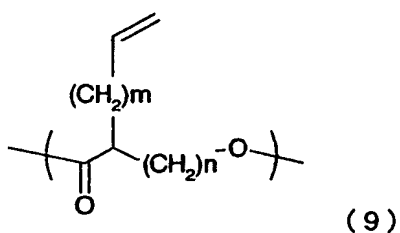


wherein n represents an integer selected from 1 to 4 when n represents an integer selected from 1, 2, and 4, m represents an integer selected from 0 to 8, and when n = 3, m represents an integer selected from 0 and 2 to 8,

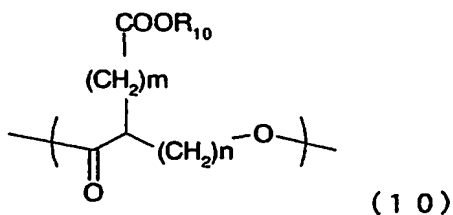


wherein n represents an integer selected from 1 to 4, when n represents an integer selected from 1, 2, and 4, m represents an integer selected from 0 to 8, when
5 n = 3, m represents an integer selected from 0 and 2 to 8, and when multiple units exist, m and n each independently have the above meaning for each unit.

7. A method of producing a polyhydroxyalkanoate containing a unit represented by the chemical formula (10), comprising the step of oxidizing a double bond portion of a polyhydroxyalkanoate containing a unit represented by the chemical formula (9),

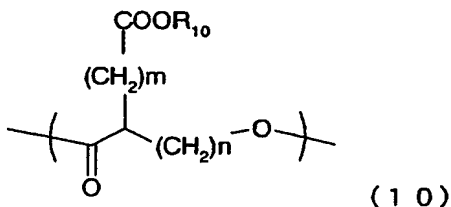


wherein n represents an integer selected from 1 to 4
15 and m represents an integer selected from 0 to 8,
when multiple units exist, m and n each independently
have the above meaning for each unit,

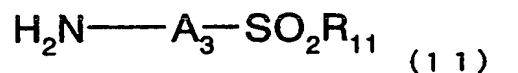


wherein R_{10} represents a hydrogen atom or a group for forming a salt, n represents an integer selected from 1 to 4, m represents an integer selected from 0 to 8, and when multiple units exist, m , n , and R_{10} each independently have the above meaning for each unit.

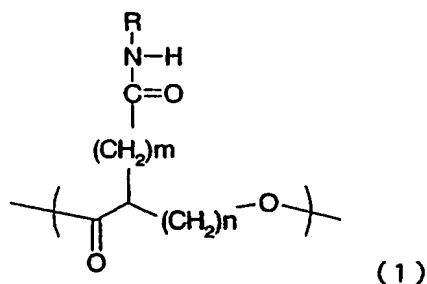
8. A method of producing a polyhydroxyalkanoate containing a unit represented by the chemical formula (1), comprising the step of subjecting a polyhydroxyalkanoate containing a unit represented by the chemical formula (10) and at least one kind of amine compound represented by the chemical formula (11) to a condensation reaction,



Wherein R_{10} represents hydrogen or a group for forming a salt, n represents an integer selected from 1 to 4, m represents an integer selected from 0 to 8, and when multiple units exist, m , n , and R_{10} each independently have the above meaning for each unit,



wherein R_{11} represents OH, a halogen atom, ONa, OK, or OR_{11a} , R_{11a} and A_3 are each independently selected from groups each having a substituted or unsubstituted
 5 aliphatic hydrocarbon structure, a substituted or unsubstituted aromatic ring structure, or a substituted or unsubstituted heterocyclic structure, and when multiple units exist, R_{11} , R_{11a} , and A_3 each independently have the above meaning for each unit,



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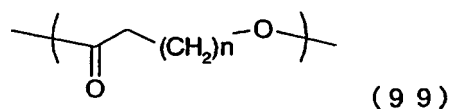
wherein R represents $-\text{A}_1-\text{SO}_2\text{R}_1$, R_1 represents OH, a halogen atom, ONa, OK, or OR_{1a} , R_{1a} and A_1 each independently represent a group having a substituted or unsubstituted aliphatic hydrocarbon structure, a
 15 substituted or unsubstituted aromatic ring structure, or a substituted or unsubstituted heterocyclic structure, n represents an integer selected from 1 to 4, m represents an integer selected from 0 to 8, and when multiple units exist, R , R_1 , R_{1a} , A_1 , m , and n
 20 each independently have the above meaning for each

unit.

9. A method of producing a polyhydroxyalkanoate containing a unit represented by the chemical formula (101), comprising the steps of:

5 allowing a polyhydroxyalkanoate containing a unit represented by the chemical formula (99) to react with a base; and

 allowing the compound obtained in the foregoing step to react with a compound represented by the
10 chemical formula (100),



wherein n represents an integer selected from 1 to 4, and when multiple units exist, n's each independently have the above meaning for each unit,



(100)

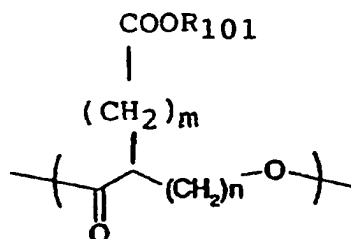
)

15

wherein m represents an integer selected from 0 to 8, X represents a halogen atom, R₁₀₀ represents a linear or branched alkyl or aralkyl group having 1 to 12 carbon atoms, and when n = 4 in the chemical formula

20 (99), m is not equal to 0,

214

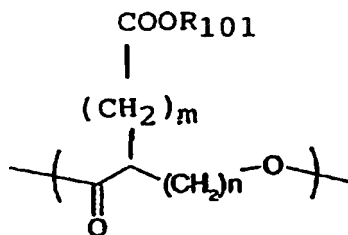


(101)

wherein n represents an integer selected from 1 to 4,
 when n represents an integer selected from 1 to 3, m
 represents an integer selected from 0 to 8, when n =
 5 4, m represents an integer selected from 1 to 8, R₁₀₁
 represents a linear or branched alkyl or aralkyl
 group having 1 to 12 carbon atoms, and when multiple
 units exist, R₁₀₁, m, and n each independently have
 the above meaning for each unit.

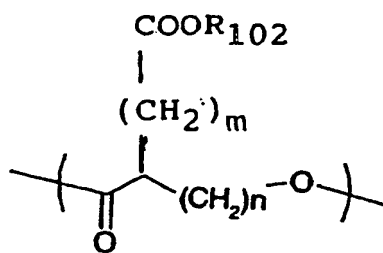
10 10. A method of producing a
 polyhydroxyalkanoate containing a unit represented by
 the chemical formula (102), comprising the step of
 hydrolyzing a polyhydroxyalkanoate containing a unit
 represented by the chemical formula (101) in the
 15 presence of an acid or an alkali or the step of
 subjecting the polyhydroxyalkanoate to hydrogenolysis
 including catalytic reduction,

215



(101)

wherein n represents an integer selected from 1 to 4,
 when n represents an integer selected from 1 to 3, m
 represents an integer selected from 0 to 8, when n =
 5 4, m represents an integer selected from 1 to 8, R₁₀₁
 represents a linear or branched alkyl or aralkyl
 group having 1 to 12 carbon atoms, and when multiple
 units exist, R₁₀₁, m, and n each independently have
 the above meaning for each unit,



(102)

10

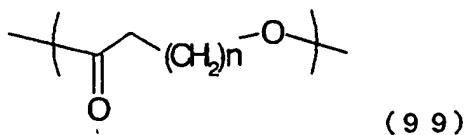
wherein R₁₀₂ represents hydrogen or a group for
 forming a salt, n represents an integer selected from
 1 to 4. when n represents an integer selected from 1
 to 3, m represents an integer selected from 0 to 8,
 15 when n = 4, m represents an integer selected from 1
 to 8, and when multiple units exist, R₁₀₂, m, and n
 each independently have the above meaning for each

unit.

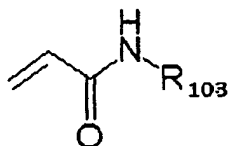
11. A method of producing a polyhydroxyalkanoate containing a unit represented by the chemical formula (104), comprising the steps of:

5 allowing a polyhydroxyalkanoate containing a unit represented by the chemical formula (99) to react with a base; and

allowing the compound obtained in the foregoing step to react with a compound represented by the
10 chemical formula (103),



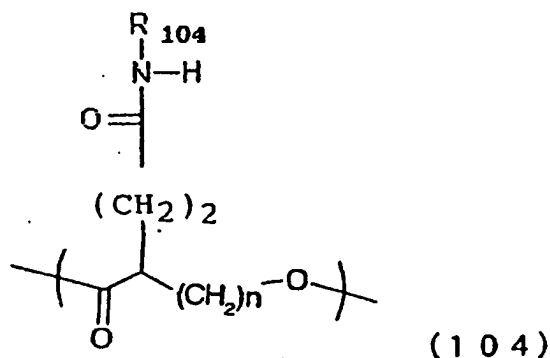
(In the formula, n represents an integer selected from 1 to 4. When multiple units exist, n's each independently have the above meaning for each unit.)



15

Wherein R_{103} represents $-A_{103}-SO_2R_{103a}$, R_{103a} represents OH, a halogen atom, ONa, OK, or OR_{103b} , R_{103b} and A_{103} are each independently selected from groups each having a substituted or unsubstituted aliphatic

hydrocarbon structure, a substituted or unsubstituted aromatic ring structure, or a substituted or unsubstituted heterocyclic structure, and when multiple units exist, R_{103} , R_{103a} , R_{103b} , and A_{103} each
 5 independently have the above meaning for each unit,



Wherein n represents an integer selected from 1 to 4, R_{104} represents $-A_{104}-SO_2R_{104a}$, R_{104a} represents OH, a halogen atom, ONa, OK, or OR_{104b} , R_{104b} and A_{104} each
 10 independently represent a group having a substituted or unsubstituted aliphatic hydrocarbon structure, a substituted or unsubstituted aromatic ring structure, or a substituted or unsubstituted heterocyclic structure, and when multiple units exist, R_{104} , R_{104a} ,
 15 R_{104b} , A_{104} , and n each independently have the above meaning for each unit.